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## ROVNO AMBER CADDISFLIES (INSECTA, TRICHOPTERA) FROM DIFFERENT LOCALITIES, WITH INFORMATION ABOUT THREE NEW SITES

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**Rovno Amber Caddisflies (Insecta, Trichoptera) from Different Localities, with Information about Three New Sites.** Perkovsky, E. E. — The inventory of the trichopterofaunas of all Rovno amber sites is provided for the first time. Syninclusions of all Rovno amber caddisflies determined to the species level are also listed for the first time. At least 29 named species are known in Klesov, as compared with only 21 species recorded in Bitterfeld amber. Eocene caddisflies are recorded in Belarus and Zhitomir Region for the first time, and new sites of inclusions are revealed as well: Rechitsa in Belarus, Olevsk in Zhitomir Region, Kuchotskaya Volia in Rivne Region. Rechitsa yielded *Erotesis bessylenon* Melnitsky et Ivanov, 2016, the first undoubtedly new Eocene taxon described from Belarus. This paper is also the first to involve the data on Danish amber caddisflies in comparison of the faunas. Only five genera from four families (*Wormaldia* McLachlan, 1865, *Archaeotinodes* Ulmer, 1912, *Lype* McLachlan, 1878, *Holocentropus* McLachlan, 1878, and *Plectrocnemia* Stephens, 1836) are known from four European Lagerstätten: Baltic, Bitterfeld, Danish and Rovno amber. *Archaeotinodes igneusaper* Melnitsky, 2009 is mentioned for Rovno amber for the first time. Genera *Allotrichia* McLachlan, 1880 (Hydroptilidae) and *Palaeocrunoecia* Ulmer, 1912 (Lepidostomatidae) are excluded from the Rovno amber fauna.

**Key words:** Eocene, Trichoptera, Rovno amber, Danish amber, *Archaeotinodes*, Ukraine, Belarus, Rivne Region, Zhitomir Region, new localities.

The new caddisfly species of Rovno amber are described in a series of papers (Melnitsky, Ivanov, 2010, 2013, 2016 a, b). Unfortunately, all these publications except the first one do not mention the type localities of the Rovno amber species, localities where Baltic amber species were found in Ukraine, and data on caddisfly syninclusions in the amber collection of Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine, Kyiv (SIZK). The only previously published Rovno amber syninclusion with trichopterans was the unique one with two *Beraeodes pectinatus* Ulmer, 1912 synincluded with thermophile ants (Perkovsky, 2013: private collection of Sergey A. Suvorkin). This record is exceptional due to the fact that the larval Beraeidae populate springs and streams with clear, cold water, and their coexistence with thermophilic ants is unexpected.

The essential majority of SIZK amber collection was obtained from the State Enterprise “UkrAmber” (Rivne). For almost all years of operation of “UkrAmber”, its only source of amber had been Pugach quarry of the Klesov amber deposit except that other amber locations were also mined experimentally for some time; in particular, in Dubrovitsa (Volnoje) (Fedotova, Perkovsky, 2008) (fig. 1). Then, the ambers of different locations were combined at the factory; we marked it as UA encompassing the Rovno amber with arthropod inclusions that has been



Fig. 1. Map of the type localities of Rovno amber caddisflies.

collected at Klesov (the majority of inclusions), Dubrovitsa (less than one third of inclusions) and Vladimirets deposits (insignificant quantity), all three in Rivne Region (Perkovsky et al., 2007). A sample from Vyrka is obtained from Rovno Geology Expedition of the State Regional Geological Enterprise “Pivnichgeologiya” (Vlaskin, Perkovsky, 2005). Samples from Olevska (Zhytomyr Region) (fig. 2, 1) and Rechitsa (Belarus, Gomel region, left bank of Horyn River, 7 km from Ukrainian border) (fig. 1) were purchased from collectors. Rechitsa yielded *Erotesia bessylenon* Melnitsky et Ivanov, 2016 (Leptoceridae), the first undoubtedly new Eocene taxon described from Belarus (Perkovsky, Bogdasarov, 2009); *Holocentropus* sp. (Polycentropodidae) is known from the same locality (fig. 2, 3–4). Aside from the mentioned localities the polycentropodid *Plectrocnemia* sp. (a female in a very good condition, fig. 2, 2) was excavated from the extreme northwest of Rivne Region (Zarichne District, Kuchotskaya Volia) and two synincluded polycentropodids were found in a sample from Gulyanka (Zhitomir Region; see Fedotova, Perkovsky, 2015). The list of syninclusions of trichopterans (determined to the species level from SIZK collection) is compiled below (table 1, number of specimens in brackets). Genera *Allotrichia* McLachlan, 1880 (Hydroptilidae) (Perkovsky et al., 2003: fig. 3) and *Palaeocrunoecia* Ulmer, 1912 (Lepidostomatidae) (Perkovsky et al., 2003) were mistakenly identified in Rovno amber and are now known as fossils only of Baltic amber (Ivanov et al., 2016).

The analysis of composition of syninclusions of the biting midges (Diptera, Ceratopogonidae) in the Rovno amber (Perkovsky, Rasnitsyn, 2013) has revealed that in the communities of the amber forest the caddisflies form a pleiad together with biting midges *Culicoides* Latreille, 1809. In these communities, the caddisflies were represented mainly by Polycentropodidae which comprise 72 % of those identified to the family level by 2013 (Perkovsky, Rasnitsyn, 2013). Both *Culicoides* and caddisflies develop in water bodies and so are less common deep in a forest: this might account for their correlation. Both caddisflies synincluded with female *Culicoides* and identified to the family level belong

Table 1. List of named Rovno amber caddisflies (Trichoptera)

Caddisfly	Locality	N reg	Syninclusions
<i>Wormaldia nasticentia</i> Melnitsky et Ivanov 2010	Klesov	<b>Philopotamidae</b> K-5318 K-9519	Collembola: Symphyleona indet. (1) Diptera: Psychodidae indet. (1); Collembola: Entomobryomorpha indet. (2); Acari: Trombididae indet. (1), Acari indet. (1)
<i>Wormaldia pobeda</i> Melnitsky et Ivanov 2016	Klesov		
<i>Archaeotinetodes reveraverus</i> Melnitsky et Ivanov 2010	Klesov or Dubrovitsa	<b>Ecnomidae</b> UA-1651, UA-1651a, UA-1651b (one amber piece) K-4080 K-27396	Trichoptera indet. (1)
<i>Archaeotinetodes malickyi</i> Melnitsky et Ivanov 2016	Klesov		
<i>Archaeotinetodes igneusaper</i> Melnitsky 2009	Klesov	<b>Psychomyiidae</b> K-6687, K-6687a (one amber piece) K-941	Acari indet. (1)
<i>Lype essentia</i> Melnitsky et Ivanov 2013	Klesov		
<i>Lype sericea</i> (Pictet 1856)	Klesov	K-3253 UA-2312	
<i>Lype sericea</i> (Pictet 1856)	Klesov		
<i>Polycentropodidae</i>	Klesov or Dubrovitsa	K-8540	
<i>Archaeoneureclipsis martynovi</i> Melnitsky et Ivanov 2016	Klesov		
<i>Electrocymus perpusillus</i> Melnitsky et Ivanov 2010	Vyrka****	DU-131 K-7332	Diptera: Chironomidae: Tanypodinae indet. (1), Chironomidae: Orthocladiinae indet. (7), Ceratopogonidae: <i>Culicoides</i> indet. (1), Sciaridae indet. (1), Mycetophilidae indet. (1), Brachycera indet. (1); Coleoptera: Aderidae indet. (1); Homoptera: Aphidinea indet. (1), Cicadellidae indet. (1); Collembola: Entomobryomorpha indet. (1); Aranei: Oonopidae: <i>Orchestina</i> indet. (1); Acari: Glaesacaridae: <i>Glaesacarus rhombeus</i> (Koch & Berendt) (1)
<i>Holocentropus affinis</i> (Pictet 1856)	Klesov		
<i>Holocentropus flexiflagrum</i> Melnitsky et Ivanov 2010	Dubrovitsa	D-2277	
<i>Holocentropus flexiflagrum</i> Melnitsky et Ivanov 2010	Klesov	K-6649	
<i>Holocentropus flexiflagrum</i> Melnitsky et Ivanov 2010	Klesov or Dubrovitsa	UA-997	
<i>Holocentropus incertus</i> (Pictet 1856)	Klesov	K-24596 OL-1	Aranei: Zodariidae indet. (1); Acari indet. (1)
<i>Holocentropus incertus</i> (Pictet 1856)	Olevsk		
<i>Holocentropus curvatus</i> Ulmer 1912	Klesov	K-4482	
<i>Holocentropus kobodok</i> Melnitsky et Ivanov 2013	Klesov	K-3920	
<i>Holocentropus zhiltsovae</i> Melnitsky et Ivanov 2013	Klesov or Dubrovitsa	UA-784	
<i>Nyctiophylax terreusbos</i> Melnitsky et Ivanov. 2013	Klesov	K-4837	
<i>Nyctiophylax varians</i> Ulmer	Klesov	K-25143	
<i>Plectrocnemia barbata</i> Ulmer 1912	Klesov	*	

<i>Plectrocnemia lata</i> (Pictet 1856)	Klesov	*		
<i>Plectrocnemia nastigermania</i> Melnitsky et Ivanov 2013	Klesov	K-408		
<i>Plectrocnemia ucrainum</i> Melnitsky et Ivanov 2013	Klesov	K-3801		
<i>Polycentropus grigorenko</i> Melnitsky et Ivanov, 2016	Klesov	K-6954	6954a (one amber piece)	
<b>Hydroptilidae</b>				
<i>Agraylea electroscentia</i> Melnitsky et Ivanov 2010	Klesov	K-5378		
<i>Oxyethira lurida</i> Melnitsky et Ivanov 2016	Klesov	K-24370		
<i>Orthotrichia umbra</i> Melnitsky et Ivanov 2016	Klesov	K-26172		
<i>Eotrichostegia retrograda</i> Melnitsky et Ivanov 2016	Klesov	K-7354		
			<b>Phryganeidae</b>	
				Diptera: Dolichopodidae indet. (1)
				Coleoptera: Curculionidae indet. (1), Staphylinidae: Pselaphinae indet. (1), Staphylinidae: Scydmaenitae: Glandularini: <i>Rovnoscydmus</i> indet. (1); Elateridae indet. (1); Hymenoptera: Ichneumonidae indet. (1), Formicidae: <i>Lasius schiefferdeckeri</i> Mayr (1); Homoptera: Aphrophoridae indet. (1); Diptera: Cecidomyiidae: <i>Aprionus</i> sp. (2), Psychodidae indet. (1), Tipuloidea indet. (1), Mycetophilidae indet. (1); Collembola: Entomobryomorpha indet. (1); Acari: Cunaxidae indet. (1), Damaeidae indet. (1), Erythraeidae indet. (1)
Phryganeidae gen. sp.**	Klesov			
<b>Beraeidae</b>				
<i>Beraeodes pectinatus</i> Ulmer 1912***	Klesov			
<b>Calamoceratidae</b>				
Calamoceratidae gen. sp.	Klesov			
Leptoceridae				
<i>Triplectides palaeoslavicus</i> Melnitsky et Ivanov 2010	Klesov	K-5355		Aranei indet. (1)
<i>Ceraclea</i> sp.	Klesov	K-5353		
<i>Leptocerus solifemella</i> Melnitsky et Ivanov 2010	Klesov	K-2805		
				Coleoptera: Staphylinidae: Pselaphinae indet. (1); Diptera: Chironomidae: Chironominae indet. (1), Homoptera: Aphidinea indet. (1); Collembola: Entomobryomorpha indet. (3), Symphyleona indet. (1); Acari: Trombididae indet. (1), Acari indet. (2); Homoptera: Aleyrodidae indet. (1); Aranei indet. (1)
<i>Erotesis aequalis</i> Ulmer 1912	Klesov	K-4747		
<i>Erotesis bessylenon</i> Melnitsky et Ivanov 2016	Rechitsa	G-9		
				Hymenoptera: Diapriidae: Belytinae, Pantolytini (1), Belytinae (1), Aphelinidae (1), Hymenoptera indet. (1); Diptera: Chironomidae: Orthocladinae indet. (1), Sciaridae (2), Sciaroidea indet. (1); Lepidoptera indet. (1); Homoptera: Cicadinea indet. (1); Collembola: Symphyleona indet. (1); Opiliones indet. (1); Acari indet. (1);

\* *Plectrocnemia barbata* and *Plectrocnemia lata* both found in Klesov, but this species-group in Rovno amber need a revision (Melnitsky, Ivanov, 2016 b), so specimens not included in the table.

\*\* Not *Eotrichostegia*. In private collection of Victor Gusakov (**Zvyozdny**, Moscow Region)

\*\*\* In private collection of Sergej Suvorkin (Kiev). Syninclusions indicated in Perkovsky, 2013.

\*\*\*\* Mapped with other type localities on fig. 1.



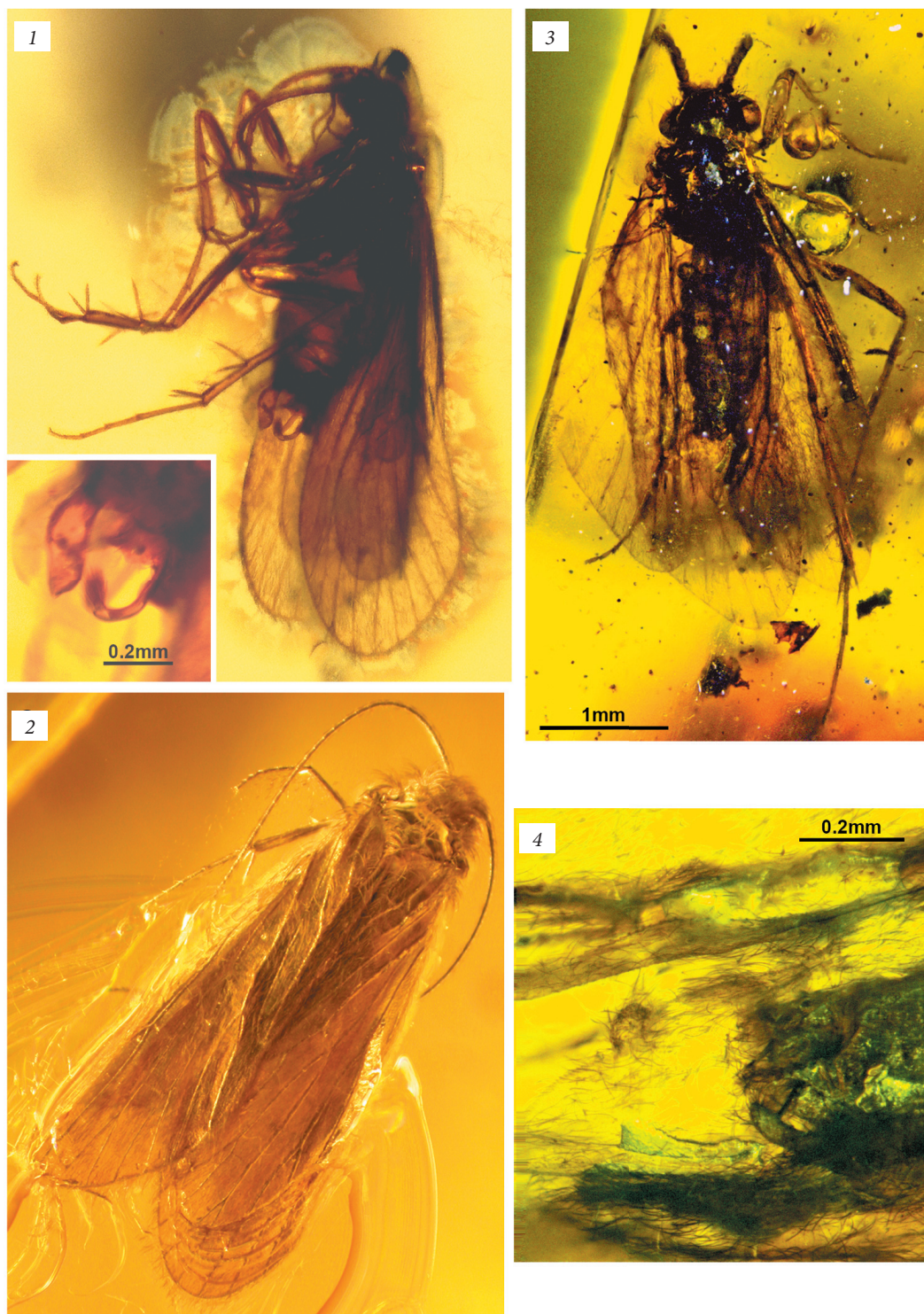


Fig. 2. Polycentropodids from the new sites: 1 — *Holocentropus incertus* (Pictet 1856) from Olevsk; 2 — *Plectrocnemia* sp. from Kuchotskaya Volia; 3–4 — *Holocentropus* sp. from Rechitsa: 3 — habitus, 4 — genitalia.

**Table 2.** Caddisflies from the Late Eocene ambers of Europe (the dagger symbol † indicates taxa known only as fossils)

Family	Genera (Number of species)			
	Baltic amber	Danish amber	Bitterfeld amber	Rovno amber
Philopotamidae	† <i>Electracanthinus</i> (1), <i>Philopotamus</i> (1), † <i>Ulmerodina</i> (1) <i>Wormaldia</i> (6)	<i>Wormaldia</i> (1)	<i>Wormaldia</i> (3)	<i>Wormaldia</i> (2)
Stenopsychidae	<i>Stenopsyche</i> (1)		—	—
Hydropsychidae	<i>Diplectrona</i> (2), † <i>Electrodiplectrona</i> (1), <i>Hydropsyche</i> (2)		—	—
Dipseudopsidae	<i>Phylocentropus</i> (4)		—	—
Ecnomidae	† <i>Archaeotinodes</i> (18)	† <i>Archaeotinodes</i> (1)	† <i>Archaeotinodes</i> (1)	† <i>Archaeotinodes</i> (3)
Psychomyiidae	<i>Lype</i> (3)	<i>Lype</i> (2)	<i>Lype</i> (2)	<i>Lype</i> (3)
Polycentropodidae	† <i>Archaeoneureclipsis</i> (2), <i>Holocentropus</i> (21), <i>Neureclipsis</i> (4), <i>Nyctiophylax</i> (24), † <i>Nyctiophylacodes</i> (1), <i>Plectrocnemia</i> (21)	<i>Holocentropus</i> (5), <i>Neureclipsis</i> (1), † <i>Nyctiophylacodes</i> (1), <i>Nyctiophylax</i> (1), <i>Plectrocnemia</i> (3)	<i>Holocentropus</i> (4), <i>Plectrocnemia</i> (7),	† <i>Archaeoneureclipsis</i> (1), † <i>Electrocyrnus</i> (1), <i>Holocentropus</i> , <i>Nyctiophylax</i> (2), <i>Polycentropus</i> (1), <i>Plectrocnemia</i> (8)
Rhyacophilidae	<i>Rhyacophila</i> (8)	<i>Rhyacophila</i> (2)	<i>Rhyacophila</i> (1)	—
Hydrobiosidae	† <i>Electrochorema</i> (1), † <i>Meyochorema</i> (1)		—	—
Glossosomatidae	<i>Electragapetus</i> (4)		—	—
Hydroptilidae	<i>Agraylea</i> (3), <i>Allotrichia</i> (4), † <i>Electrotrichia</i> (1)	<i>Agraylea</i> (1)	—	<i>Agraylea</i> (1), <i>Orthotrichia</i> (1), <i>Oxyethira</i> (1)
Ptilocolepidae	<i>Palaeagapetus</i> (1)		—	—
Phryganeidae	<i>Phryganea</i> (7) <i>Trichostegia</i> (1)		—	† <i>Eotrichostegia</i> (1) Phryganeidae gen. sp. (1)
†Yantarocentridae	† <i>Yantarocentrus</i> (1)		—	—
Brachycentridae	<i>Brachycentrus</i> (1)		—	—
Goeridae	<i>Goera</i> (1), <i>Lithax</i> (2), <i>Silo</i> (1)		—	—
Lepidostomatidae	<i>Lepidostoma</i> (6), † <i>Archaeocrunoecia</i> (3), † <i>Electrocrunoecia</i> (1), † <i>Maniconeurodes</i> (2)		—	<i>Lepidostoma</i> (1)
Apataniidae	† <i>Electroapatania</i> (1)		—	—
Limnephilidae	† <i>Electrocryptochia</i> (1)		—	—
Beraeidae	<i>Beraeodes</i> (1)		—	<i>Beraeodes</i> (1)
†Ogmomyiidae	† <i>Ogmomyia</i> (3)		—	—
Helicopsychidae	† <i>Fusuna</i> (1), † <i>Electrohellicopsyche</i> (1), <i>Helicopsyche</i> (5), † <i>Palaeohelicopsyche</i> (2)		—	—
Sericostomatidae	† <i>Aulacomia</i> (2), † <i>Pseudoberaeodes</i> (1), † <i>Sphaleropalpus</i> (1), † <i>Stenoptilomyia</i> (2)		—	—
Calamoceratidae	<i>Ganonema</i> (1), <i>Georgium</i> (1), † <i>Electroganonema</i> (1)		—	Calamoceratidae gen. sp. (1)
Molannidae	<i>Molanna</i> (3), <i>Molannodes</i> (2)		—	—
Odontoceridae	† <i>Electrocerum</i> (1), † <i>Electropsilotes</i> (1), <i>Marilia</i> (3)		—	—

Leptoceridae	<i>Erotesis</i> (1), <i>Setodes</i> (1), † <i>Electroleptorussa</i> (1), <i>Triaenodes</i> (2), † <i>Electro-</i> <i>triaenodes</i> (1), † <i>Elec-</i> <i>troadicella</i> (3), † <i>Peris-</i> <i>somyia</i> (1), <i>Triplectides</i> (4), 27 families, 64 genera, 210 species	<i>Setodes</i> (1)  7 families, 11 genera, 17 spe- cies	† <i>Electroadi-</i> <i>cella</i> (3)  6 families, 7 genera, 21 species	<i>Ceraclea</i> (1), <i>Erotesis</i> (2), <i>Leptocerus</i> (1), <i>Triplectides</i> (1),  10 families , 21 genera, 42 species
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to Polycentropodidae, and one of them belongs to *Plectrocnemia* Stephens, 1836, whose larvae now develop in cool rivers, streams and springs, which might be the case of larvae of *Culicoides* (*Oecacta*) found in Priabonian amber as well (Perkovsky, Rasnitsyn, 2013).

By courtesy of Lars Vilhelmsen (2015, pers. com.) unpublished data on trichoptera-fauna of Danish amber are available for comparison (table 2). Only five genera from four families (*Wormaldia* McLachlan, 1865, *Archaeotinodes* Ulmer, 1912, *Lype* McLachlan, 1878, *Holocentropus* McLachlan, 1878, and *Plectrocnemia*) are found in all four ambers, Baltic, Danish, Saxonian and Rovno. Three more genera, *Nyctiophylax* Brauer, 1865, *Agraylea* Curtis, 1834 and *Rhyacophila* Pictet, 1834 are found to occur in three ambers: *Nyctiophylax* and *Agraylea* in all ambers except Danish amber and *Rhyacophila* in all ambers except Rovno amber. Hence, only seven trichopteran genera of five families are known for at least three different Late Eocene ambers (table 2).

List of Rovno caddisflies species is supplemented by the economid species *Archaeotinodes igneusaper* Melnitsky, 2009, which was not previously known there. The unnamed Rovno species listed by Melnitsky, Ivanov (2016 a) are not included in table 1 but are included in table 2, as in our previous paper (Ivanov et al., 2016).

Thus, the lion’s share of what we know of Rovno trichopteran fauna applies only to local fauna of Klesov. Accumulating comparable data for other localities is currently unlikely because the deposits are incomparably less productive and their mining is not conducted legally, which makes correct provenance of new samples hardly possible.

It is important to note that Late Eocene trichopterofaunas of Europe and North America are in general very different from the contemporary and most Neogene faunas in dominance of Psychomyioidea and total absence of the advanced limnephilids (Ivanov et al., 2016). Dominance of Psychomyioidea is ensured by the absolute dominance of polycentropodids; Polycentropodidae constitute 84 % of all caddisflies both in Baltic amber (Ulmer, 1912) and in North American Lagerstätte Florissant (Ivanov et al., 2016); in other Late Eocene ambers polycentropodids dominate as well (Ivanov et al., 2016). The single find of Late Eocene primitive limnephilid in Baltic amber has been published only three years ago (Wichard, 2013). Revision of Danish material and a more detailed analysis of Rovno amber will contribute to a better understanding of this important stage in the evolution of freshwater ecosystems (Ivanov et al., 2016).

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